NASA Routine Payload EA Concept through Development, Use, Benefits, and Update

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Regulations, Need, and Precedent for a Programmatic EA

- Applicable Regulations:
  - The Council of Environmental Quality (CEQ 40 CFR §1502.4(b)) encourages reduction of excessive paperwork which could be accomplished by consolidation of routine payloads into a programmatic NEPA document
  - NASA NEPA Regulations encourage Programmatic documents for broad actions grouped by relevant similarities (NPR 8580.1, section 7.6.1)
- NASA Precedent for Programmatic Environmental Assessments
  - Programmatic EAs were successfully developed for the Earth Observing System (EOS) Program and the New Millennium (NP) Program
  - Similarity of proposed action, purpose and need
  - Similarity of spacecraft
- Need for a Programmatic EA for Routine Payloads
  - Prior to June 2002, routine payload missions that were not part of EOS or NM Programs required the development of a mission-specific EA. These NASA missions had similar characteristics:
    - they were to launch from launch sites on launch vehicles for which NEPA documentation had been completed, and
    - no new potential significant impacts were anticipated
    - Spacecraft characteristics could be bounded by Envelope Payload Characteristics (EPCs) and evaluated via a checklist.

NASA Routine Payload Environmental Assessment (NRP EA) Concept

- Plan
  - Develop a Broad Scope NEPA Document to Satisfy NASA NEPA Review Requirements for a Variety of “Routine” Payloads to Be Launched From Existing Domestic Launch Sites Over The Next 20 Year Period
- Approach
  - Construct for Purposes of Review a Hypothetical Spacecraft, Defined by a Set of Envelope Payload Characteristics (EPCs)
    - Developed EPCs by Surveying Missions in Planning or Development Stages
    - Used NASA, NOAA, and US Air Force Spacecraft to Determine EPCs
  - Assume a Broad Range of Launch Vehicles, from Domestic Launch Sites
  - Incorporate by Reference and Summarize Existing Environmental Review Documents for Launch Vehicles Included in the Launch Vehicle Set
  - Assess Potential Payload-Specific Environmental Impacts Based Upon the EPC Inventory
  - Establish a Periodic Review Cycle to Update the Broad Scope Document as Necessary

NRP EA - Proposed Action

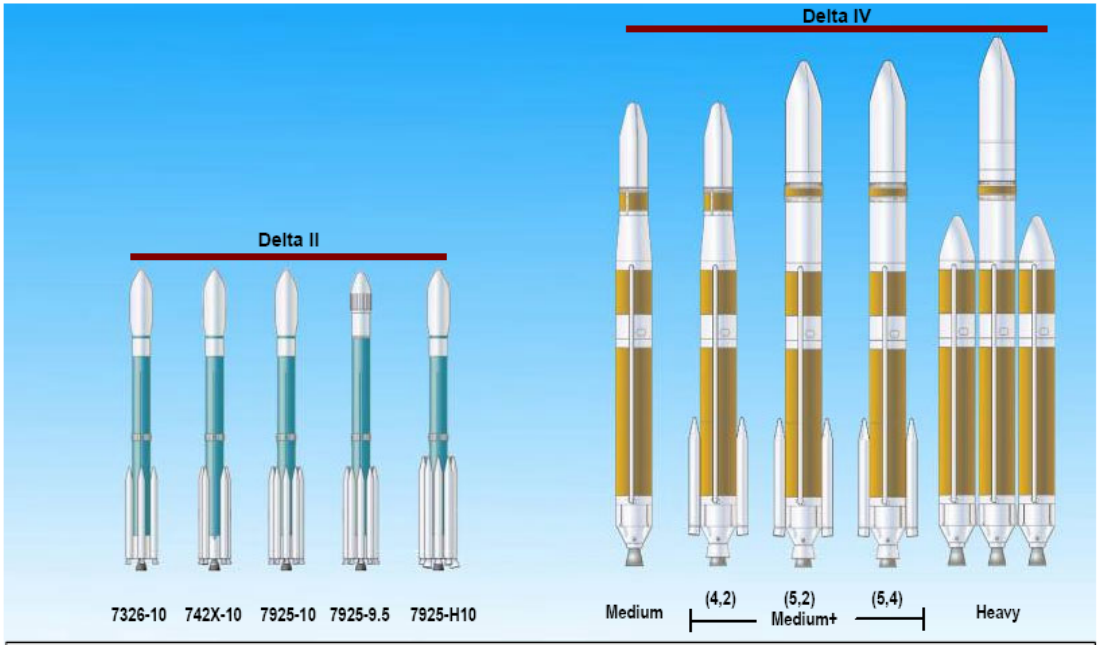
- Payloads would be launched from existing domestic launch sites, including:
  - Space Launch Complexes at Cape Canaveral Air Force Station (CCAFS), Florida;
  - Vandenberg Air Force Base (VAFB), California;

- Spacecraft and mission design would encompass NASA's four science areas: Planetary Exploration, Earth Observation, Astrophysics Investigations, and Space Physics Studies.

- Launch vehicles would include Small, Medium-Light, Medium, and Intermediate Expendable class launch vehicles, the Evolved Expendable medium and heavy class launch vehicles.

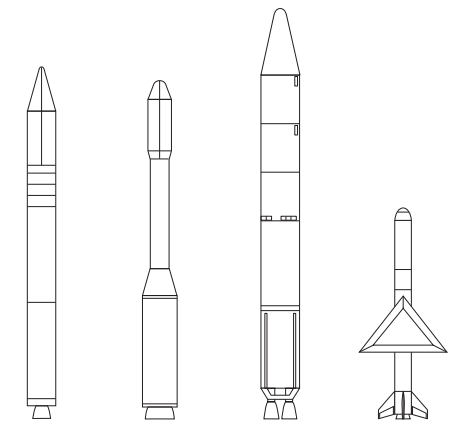
Launch Vehicles Covered by 2002 NRP EA

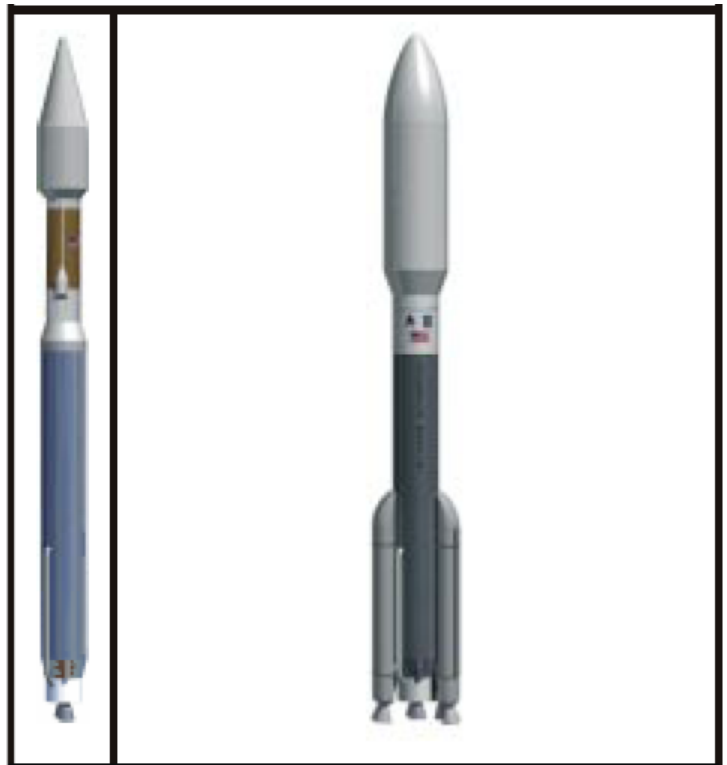
Launch Approval Engineering



GTO	(kg)	894	1,032	1,759	1,832	2,133	4,231	5,941	4,869	6,822	12,757
LEO	(kg)	2,472	2,880	4,598	4,783	5,648	9,106	12,305	10,616	13,864	21,892
GEO	(kg)						1,138	2,036	1,686	2,786	6,276

GTO = 185 x 35,786 km at 28.7 deg Delta II and 27.0 deg Delta IV. LEO = 407 km circular at 28.7 deg.
GEO = 35,786 km circular at 0 deg





Atlas V 400	Atlas V 500					
401	501	511	521	531	541	551
Performance to GTO, kg (lb)						
4,950	3,970	5,270	6,285	7,200	7,980	8,670
(10,913)	(8,752)	(11,618)	(13,856)	(15,873)	(17,593)	(19,114)

NRP EA Approach - Preliminary EPCs and Checklist

- **Radioactive Materials**
  - Less than 10 x A_2 value from IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition as amended in 1990, Table 1
  - No Radioisotope Power Sources (RPS) or Radioisotope Heater Units (RHUs)
- **Non-Ionizing Radiation Sources (Lasers)**
  - 10 kiloWatt (kW) radar
  - ANSI Z136 calculation of maximum ground exposure at 532 and 1064 nanometers (nm)
- **Solid Propellant**
  - 600 kilograms (kg)
- **Liquid Propellant**
  - 1,000 kg hydrazine or Monomethyl hydrazine (MMH), 1,200 kg Nitrogen Tetroxide (NTO)
- **Battery Fluids or Other Hazardous Chemicals**
  - 150 Amp-Hour (A-hr) NiH_2, 200 A-hr $Li/SOCl_2$
  - 450 liters liquid Helium, 500 kg Xenon
- **Explosives**
  - Class C Electro-explosive devices (EEDs)
- **Hazardous Structural Materials**
  - 200 kg total
- **In-flight Chemical Releases**
  - Propulsion exhaust and inert gas venting
- **EPC Checklist**
  - Incorporated With NRP EA
  - Completed by all missions that might fall under it's umbrella
- **Record of Environmental Consideration (REC)**
  - Defined Process per NPG 8580 for NEPA Review
  - No Sample Return to Earth, RPS, or RHUs
  - Launch Vehicle and Launch Site Must Be Included in NRP EA
  - If All Payload Parameters are Within the EPC Limits, Payload is Covered by NRP EA

JPL5

Where did this come from?

Jet Propulsion Laboratory, 9/11/2008

Milestones of NRP EA

- Finding of No Significant Impact (FONSI) for the NRP EA Published in Federal Register on 18 June 2002
- NASA Missions Covered within the NRP EA:
  - Contour
  - Deep Impact
  - Messenger
- NASA Missions Covered Via NRP EA Umbrella Process
  - Space Technology Missions 8 & 9
  - Phoenix
  - Mars Reconnaissance Orbiter (MRO)
  - Dawn
  - Wise
  - Aquarius
  - OSTM
  - Various NOAA missions in the GOES and POES family
  - Juno
- No public controversy has resulted from the adoption of the NRP EA
- Checklist has been used in lieu of Air Force (AF) 813 form at CCAFS and is used by VAFB to draft the AF 813 form
- Widely referenced by the DOD and FAA in their subsequent NEPA documents, e.g., Orbital/Sub-orbital Program [Minotaur] EA (AF)

NRP EA Update

- Rationale for Updating the NRP EA
  - Scheduled 5-year reevaluation showed some launch vehicles previously included , *e.g.,* Titan II, etc., were no longer available and new launch vehicles and launch sites are now available for launching NASA payloads
    - Update to the NRP EA encompasses a wider range of launch sites
      - Reagan Test Site at the U. S. Army Kwajalein Atoll in the Republic of the Marshall Islands (USAKA/RTS);
      - NASA Wallops Flight Facility (WFF), Virginia;
      - Kodiak Launch Complex (KLC), Alaska;
      - U.S. commercial launch sites holding FAA's Office of Commercial Space Transportation experimental permits or licenses:
        - Mojave Spaceport
        - Nevada Spaceport (Nevada Test Site)
        - Oklahoma Spaceport
        - Blue Origin West Texas Spaceport
    - Recently Available Launch Vehicles Included in the Update Are the Falcon 1, Falcon 9, and the Minotaur Family (1-4)
    - EPCS increased to meet the demands of larger, heavier missions
- Update to NRP EA currently scheduled to be finalized – Dec 2008

NRP EA Update Approach - EPCs and Checklist

- **Radioactive Materials**
  - Less than 10 x A_2 value from IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition as amended in 1990, Table 1
  - No RPS, RHUs, Nuclear Fission Reactors
- **Non-Ionizing Radiation Sources (Lasers)**
  - ANSI Safe lasers as per ANSI Z136 calculation of maximum ground exposure at 532 and 1064 nm
- **Communications**
  - 10 kW radar
  - 10-100 W RF transmitters
- **Solid Propellant**
  - 3000 kg (for Star-48 3rd Stage motor)
- **Liquid Propellant**
  - 2,000 kg N_2H_4 or MMH, 3,800 kg N_2O_4 JPL2
- **Battery Fluids or Other Hazardous Chemicals**
  - 5 kW-hr Li-ion or NiH_2, 300 A-hr Li/$SOCl_2$, 150 A-Hr H_2, Ni-Cd or NiH_2 batteries;
  - 450 l liquid He, 500 kg Xe
- **Explosives**
  - DOT Class 1.4 Electro-Explosive Devices JPL4
- **Hazardous Structural Materials**
  - 50 kg total beryllium
- **In-flight Chemical Releases**
  - Propulsion exhaust and inert gas venting
- **EPC Checklist**
  - Incorporated With NRP EA
- **Record of Environmental Consideration (REC)**
  - Defined Process per NPG 8580 for NEPA Review
  - No Sample Return to Earth or LEO
  - No RPSs, no RHUs, no Nuclear Fission Reactors
  - Launch Vehicle and Launch Site Included in NRP EA
  - If All Payload Parameters are Within the EPC Limits, Payload is Covered by NRP EA

* Updated quantities are highlighted in blue

JPL2 Don't know if we want to list the 2000 kgs of MMH
Jet Propulsion Laboratory, 6/2/2008

JPL4 Where did this number come from? We have DOT Class 1.4 EEDs - no where in the NRP EA does it specify a quantity
JG- came from revised classification from DOT
Jet Propulsion Laboratory, 9/10/2008

Benefits of Programmatic Approach

- Meets NASA's Requirement Under NEPA and the CEQ Guidelines to Reduce Excessive Paperwork
- Cost and Schedule Advantages
  - A mission specific EA for a Routine Payload would typically cost about $250k and take up to 2 years to complete
  - The NEPA compliance for a mission that falls under the umbrella of the NRP EA (*i.e.,* does not exceed the EPCs) typically would cost $65k and take 6 months to complete
  - Reduces the necessity of NASA HQ Personnel to review of documents containing the same information
- Missions that exceed the EPCs by a small amount do analysis to determine if there are potential significant impacts – this becomes a Memo for the File
- Gives a Programmatic Overview to the Public of NASA's Proposed Routine Payload Missions and Reduces the Possibility of a Lawsuit Brought on the Grounds of Segmentation